

STORIES BY CONNIE BRYSON

FOCUS

Move over Silicon Valley, here comes Science City. One of the world's fastest growing science and technology centres is right here in Alberta. If you were to combine Alberta's research facilities, its support networks and all the people employed directly or indirectly by technology, you would create Science City - population 200,000 - the third largest city in the province.

"It's a powerful concept," explains Fred Stewart, Alberta's minister of technology, research and telecommunications. "Our goal is to further the understanding and appreciation of the importance of science and technology to Alberta's economy and its future."

"The development of science and technology is vital to success in a global economy. Alberta is gaining in the race; but we must maintain momentum."

The provincial government is playing the role of catalyst by making Science City the focus for advertising and promotional activity in the coming year. But that's only a start. The Science City campaign is designed to have many applications. There's potential for involvement of the private sector, schools, science exhibits and fairs. Any age group can participate. In short, every Albertan has a stake in Science City.

Science City is based on an ambitious vision outlined by Stewart in a recent speech. He said:

"Our vision for advanced technology in Alberta is to see the province's technology-intensive industries represent one of the largest manufacturing sub-sectors in Alberta by the turn of the century. To be precise, we expect technology-intensive industries to account for nearly 25 per cent of the value of manufacturing shipments in the year 2000, compared to less than 10 per cent today. That means sustaining an average annual growth rate in the advanced technology sectors of about 15 per cent."

That growth is expected to translate into well-established industries or groups of allied manufacturing companies in each of the major technology streams such as telecommunications, biotechnology, electronics, computers and software, and advanced industrial materials.

As a result, Alberta will be an even greater force on the global technology scene, with companies penetrating markets far beyond its borders. At home, Albertans will see the emergence of a number of medium-sized companies and at least one large company in each technology sector.

Is it possible? Clearly, Alberta has the expertise, talent, human resources and infrastructure for future growth. Science City has already established an impressive track record. Over the past five years, it has grown from a small town to a dynamic centre of 200,000 people. There are 50,000 individuals directly employed by Science City's

1,000-plus technology-intensive companies. The community generates annual revenues of over \$2 billion.

Products and services from Alberta's technology-intensive companies not only serve to improve the quality of life for Albertans, they affect the lives of people around the world.

Calgary's NovAtel Communications Ltd. has established itself as a major player in the global cellular telephone industry. IDACOM, a specialist in the design and manufacture of sophisticated data communications testing equipment, exports over 90 per cent of its products and services to the United States, Europe and Japan. Wega-D Geophysical Ltd. will export instruments and training worth \$2.4-million to the Soviet Union. Raylo Chemicals will earn more than \$10 million this year from sales of chemicals for the biotechnology, aerospace, electronics and pharmaceutical industries in the United States and Europe.

Although computing (hardware and software) and technical services account for half of the firms in Alberta, the product array is very wide and includes product development in automation, biotechnology, environment, materials and telecommunications.

There are many winners. Myrias Research Corporation, Canada's only supercomputer maker, has developed a large-scale parallel computer which features powerful new technology. Q.C. Data Collectors Ltd. is a world leader in well log and map digitizing for the oil industry. Lakewood Systems Ltd. manufactures dataloggers that can be left in remote sites for up to two years and operate in temperatures as low as -60°C. In September, LSI Logic Corporation of Canada introduced two high-performance personal computer chip sets for world markets. The list goes on.

Science City is also a place for new technology ventures. In August 1989, the Government of Canada, Government of Alberta, and Sherritt Gordon Limited established the first major advanced industrial materials initiative for Western Canada. The new organization, called WESTAIM, is headquartered at the Sherritt Gordon site in Fort Saskatchewan. It will commercialize the results of applied research and development of market-driven, industry-led projects.

As in all technology communities, small firms generally account for most of the technology businesses. (California is still dominated by companies with 10 to 50 employees and sales up to \$300 million.) In Alberta, firms that employ over 100 people represent a little over 10 per cent of advanced technology enterprises. However, they account for 70 per cent of the advanced technology labor force. The typical company is a small business with less than 20 employees; the typical employee works with more than 250 people.

ON SCIENCE CITY ALBERTA

Advanced research and development is a hallmark of Alberta's technology sector. Aggregate R&D staff constitute 10 per cent of the estimated total advanced technology labor force. Small research groups are the norm. Three out of four firms employ less than five full-time researchers.

The provincial government strongly supports research and development at universities and other institutions. In 1986-87, Alberta's commitment to R&D was about \$300 million, the largest research budget of any province. Alberta spends more per capita on scientific activities than any province.

A discussion paper used by Can-

ada's 1989 National Technology Policy Roundtable suggests that four elements should be present in any technology-intensive community:

- a knowledge base of science and technology;
- a human resource base;
- an appropriate infrastructure and network; and
- a community vision and culture that encourage the creation of scientific and technology-based industrial strength.

The Science City campaign aims to strengthen the fourth point, science culture, by building an appreciation for what the province has accomplished in the first three.

"I believe that Alberta has done as well as any of the new technology centres around the world at building a knowledge base, human resource base and infrastructure," says Dr. Clem Bowman, president of the Alberta Research Council, the largest provincial research organization in Canada.

"Over the last decade our knowledge base has increased substantially, particularly in small and medium-sized companies. And because that knowledge is in people, the growth in the human resource base mirrors the trend in the knowledge base. And we've seen a mushrooming of specialized research institutes. The Research Council itself has doubled in size in the last 10 years.

"What we're doing in Alberta is very exciting. The province is at the cutting edge of moving Canada into a competitive position in global markets."

No less enthusiastic about Science City is Dr. David Mitchell, president of Calgary's Kairos Consultants Inc.

"We've made a very good start at creating a technological community in Alberta," he says. "There's been steady advancement in all sectors. We have to congratulate ourselves, there's a lot to feel good about.

"I think there's one clear message - we intend to press on. Building Science City is a long-term activity that takes time and costs money. We must keep the vision fresh."

THE FUTURE BELONGS TO ADVANCED TECHNOLOGY

Technology, Research and Telecommunications Minister Fred Stewart explains how advanced technology will take Alberta into the 21st century



Technology, Research and Telecommunications Minister Fred Stewart

Q. You've said the future belongs to advanced technology. What do you mean?

A. I say that because most of the value-added products and processes in the '90s will be based on technological developments and discoveries.

My department, Technology, Research and Telecommunications, is an economic portfolio. We are in the business of creating economic growth. We do it by encouraging the development of advanced technology manufacturing in Alberta.

To maintain the standard of living and quality of life Albertans have come to expect, science and technology discoveries have to be developed and manufactured in Alberta.

If we manufacture here, we create wealth here.

Q. If we are to succeed in the global competition for manufacturing in ad-

vanced technology, our R&D has to be globally competitive. Are we doing enough?

A. How could I ever say we are doing enough? What we are doing in Alberta is investing more dollars per capita in R&D than any other province in the country.

But, I think business and industry would agree we need to make more effective use of our R&D dollars. We need to concentrate on market-driven applied research, and we must commercialize those ideas. The U.S. electronics industry learned that lesson the hard way. The U.S. developed the ideas and the Japanese commercialized them to become the world leader in consumer electronics.

Q. What is being done to accelerate the momentum the premier set in motion when he set up the department in 1986 to stimulate the growth of advanced technology in Alberta?

A. We are fortunate - we have had five years to build a foundation and establish a solid infrastructure of support for Alberta business and industry.

We've built on the leadership and tradition of excellence provided by the Alberta Research Council for almost 70 years. We've added to that base of excellence the Electronics Test Centre and the Biotechnology Toll Fermentation Facility at the ARC.

The Alberta Research Council is working closely with our universities and together they are moving both basic and applied research towards commercialization.

The ARC has a toll-free "technology line" (1-800-661-2000; in Edmonton, 450-5000) to link business with

some of the best research facilities and technical expertise in the province.

We maintain the momentum by maintaining confidence in the spirit of Albertans and their ability to compete and win. Winners like INTERA, Northern Telecom, and ATRC will continue to excel if we provide them with a solid economic environment based on responsible fiscal management. That is what we are doing.

Q. Advanced technology companies are finding it tougher every day to attract the highly trained people they need. What are you doing to help them?

A. It is people who will make the critical difference in our ability to compete in a knowledge-based economy.

In the future, intellectual property will become the currency of prosperous nations. You bet people are the most important natural resource given to us.

We need to work together with Alberta Education, Alberta Advanced Education and Alberta Career Development and Employment to meet the needs of industry in the '90s.

For example, Career Development and Employment and my department have just published a brochure titled Leading Force: Advanced Technology and the Alberta Labour Market. The brochure provides information about Alberta's labor force, government research institutes, universities and lifestyle that will be of interest to employers who are involved with advanced technologies.

We are developing a student awareness program to enhance the appreciation of advanced technology among young people. If we capture the imaginations of young people, maybe by the year 2000 industry will no longer have trouble finding qualified people.

Q. With an increased emphasis on a market-driven economy, can we really afford the luxury of basic research?

A. Basic research is the foundation of advanced technology, and fostering basic research will provide us with the

intellectual currency we need to compete in the economy of the future.

However, in the context of limited financial resources, we must be more creative in the ways we develop our knowledge base.

Q. Does that mean marketing needs to play a larger role in the development cycle of new products and processes?

A. When dealing with brand new products it is not always possible to predict what the market will accept.

In the future, more work has to be done up front on defining and identifying customer needs and then developing and commercializing the products and processes to meet those needs.

The WESTAIM partnership venture among Sherritt Gordon, the federal government and the province, besides being a model of collaboration, is a good example of developing applied research which will be market-driven.

Q. Will advanced technology manufacturing pose a threat to the environment?

A. On the contrary, I believe technology will enhance the concept of sustainable development and help solve environmental problems.

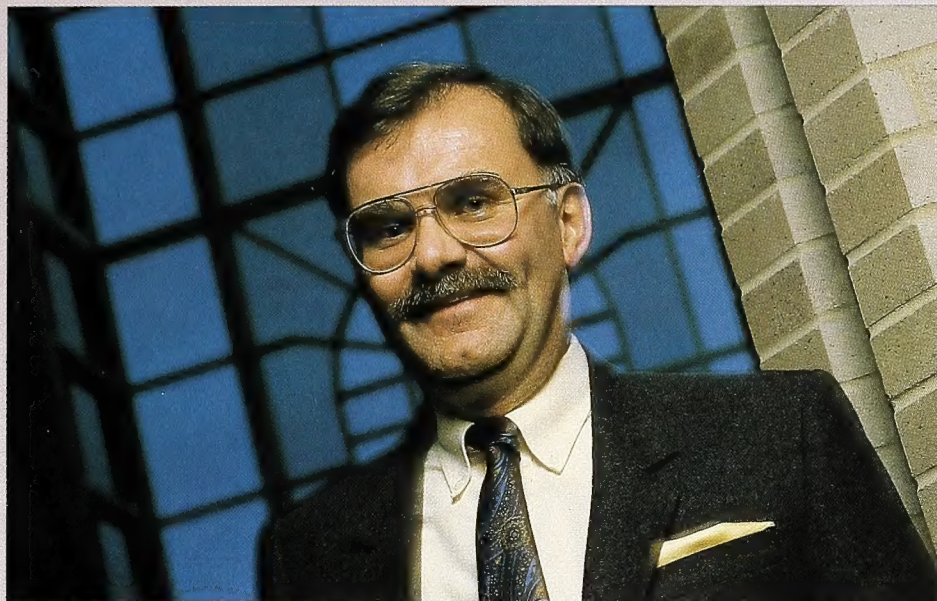
Biological pesticides are being developed at the ARC which will help replace chemical pesticides. Alternatives are being found to chlorine for use in the pulp industry. Re-usable plastics and recycling programs are being developed based on technology processes and products. Technology holds out a lot of hope for solving our environmental problems.

Q. What is your vision for the future?

A. Advanced technology will be the fastest growing area in our move to broaden Alberta's economic base. The role of the department is to provide leadership in bringing our resources, technology and people together with business and industry in a reasonable and coordinated effort.

SELLING THAT BETTER MOUSETRAP

Technology transfer is the name of the game in Science City



John Fraser: "You have to hustle, hustle, hustle."

From resource base to knowledge base, it's clear this is the direction of the Alberta economy. A knowledge-based economy is the engine that drives Science City. Fortunately for Alberta, brainpower is the province's greatest resource.

"There's incredible potential in Alberta with three universities, the Alberta Heritage Foundation for Medical Research and a supportive government," says John Fraser, president and

CEO of Calgary's University Technologies International Inc. (UTI).

"It's not enough to simply build a better mousetrap. You have to hustle, hustle, hustle."

This entrepreneurial attitude is nothing new to Albertans and it is what Fraser's company is banking on. UTI is in the technology transfer business. Its mandate is to identify technology-based business opportunities and bring them to the marketplace. UTI became fully

operational in May; its first two major clients are the University of Calgary and Calgary's Foothills Hospital.

Fraser says technology transfer opportunities are everywhere - telecommunications, computer software, biotechnology, nursing aids and electronics. Bringing them to the market involves an expertise that Albertans are just now acquiring.

"Technology transfer requires a hands-on approach with great attention to detail," Fraser says. "The opportunities are often fragile. They depend on the will of a few people; cash flow is frequently a problem. If you sneeze or hiccup at the wrong time, the opportunity can disappear."

The University of Alberta has been particularly successful at turning advances in biotechnology and biomedical research into independent companies. The university has a strong commitment to university-industry partnerships which capitalize on technologies and innovations developed by its professors.

The landmark research of the University of Alberta's Dr. Raymond Lemieux spawned Chembiomed Ltd. This biotechnology company has pioneered products for blood typing and organ transplants. Biomira Inc. markets its cancer diagnostic kits around the world. These were developed by a team of Biomira scientists headed by vice-presidents Mike Longenecker and Tony Nou-

jaim, who are also University of Alberta professors. Synthetic Peptides Incorporated is on the verge of developing an anti-bleeding compound with a potential market worth \$250 million. The company was established by University of Alberta professor Robert Hodges, one of the top peptide biochemists on the continent.

Technology transfer opportunities at the University of Calgary are no less impressive. Carrying on the work of University of Calgary professor Dr. Robert Church, Alta Genetics Inc. is known throughout the world for its elite livestock genetics and scientific expertise in high-tech cattle breeding. University of Calgary Heritage Medical Scientist Dr. John Remmers developed Tranquility, a sleeping apparatus used to treat sufferers of sleep apnea. Healthdyne Corporation, Atlanta, has licensed the system, which is now on the market.

"Traditionally, universities have related to the outside world through their graduates, but we're now exploring other mechanisms of knowledge transfer," says Dr. Bob James, vice-president (research), University of Alberta.

"Knowledge transfer from faculty, technicians and other university professionals is becoming a greater part of the role universities play in society. A successful economy must have access to outstanding research capability and this is what we have in Science City"

CITY'S ON SOLID FOUNDATION

Extensive infrastructure gives powerful R&D capability to even the smallest companies

Infrastructure is a key component of Science City and Alberta offers some of the finest research and development facilities in the world. In Alberta, small and medium-sized companies have an opportunity to develop advanced technology ideas using the same kind of research capability that is usually only enjoyed by large companies and multinational corporations.

The need for infrastructure support for research and development has long been recognized in Alberta. The Alberta Research Council, the first provincial research organization in Canada, was established in 1921. With more than 500 employees, the crown corporation remains Canada's leading provincial research body.

In 1979, a \$300-million endowment from the Heritage Savings Trust Fund was used to form the Alberta Heritage Foundation for Medical Research. The foundation has put Alberta on the medical research map and has created exciting opportunities for technology transfer of biomedical products and services.

The Alberta Oil Sands Technology and Research Authority (AOSTRA) was established in 1974 with a mandate

to develop the technology needed to realize the potential of Alberta's vast heavy oil and oil sands deposits. Technologies developed by AOSTRA have contributed to the development of the province's highly technical and versatile oil sands and heavy oil industry.

Infrastructure building on this scale does not come cheap. In the past five years alone, over \$70 million has been spent to create and support technology infrastructure.

Where has the money gone? It has created advanced technology institutions such as the Alberta Laser Institute, Alberta Microelectronic Centre, Alberta Telecommunications Research Centre, Electronics Test Centre, Biotechnology Pilot Plant, and the Centre for Frontier Engineering Research (C-FER). There is also support for research parks, business incubators, technology transfer offices and other incentive programs.

"Without being proactive about technology development, we'd be in dire straits," says Dr. Touraj Nasser, president of C-FER. "We would have to depend on foreign technology and this would have a devastating effect not

only on Alberta, but Canada too. We need an infrastructure that is effective and responsive in a rapidly changing world. However, the infrastructure alone is not sufficient to ensure global competitiveness. We need mechanisms to convert it into internationally marketable products."

C-FER is one part of Alberta's extensive infrastructure which ensures the province's performance and competitiveness in advanced technology industries. The centre was established in 1983 with a mandate to address problems related to the safe and economical development of Canada's petroleum resources. On top of performing contract and joint venture research, C-FER has its own research program specializing in offshore structures and downhole tubular systems.

Facilities such as C-FER are strong allies of private enterprise. Their R&D work helps Alberta companies maintain a technological edge over the competition. They are committed to using advanced technology to improve business through cost reductions, improved quality, new product development, and the development of new business.

The province's research institutes also provide vital connections among industry, university and government. Developers and users of new technology can take advantage of collabora-

tive education and research for innovation and advancement.

For example, at the Alberta Telecommunications Research Centre (ATRC) the emphasis is on linking academic research and industrial applications. Industry representatives, university faculty members and graduate students carry out joint research in areas such as network access, optical transmission, long-haul networking, and advanced circuit and software technologies.

Dr. Bob James, vice-president (research) at the University of Alberta, is a firm believer in the cooperative approach. He says institutes like the ATRC have many highly attractive qualities.

"... the research projects that the centre (ATRC) undertakes have a long-term perspective, but are highly germane to the needs of industry. Every effort is made to have faculty, graduate students, industrial researchers and ATRC staff working on each major project... Both sides gain considerably from this arrangement."

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OPPORTUNITIES ABOUND IN SCIENCE CITY

As "city" grows, everybody benefits

Business is booming in Science City. The number of technology-intensive companies in Alberta has grown from 600 in 1977 to over 1,000 in 1989, with many of these companies established in the last five years. There's optimism and excitement about growth and future opportunities.

"The growth of Science City makes a big difference to high-tech companies," says Dr. Cliff Anger, president of ITRES Research Ltd., a small Calgary company which specializes in remote sensing using its proprietary compact airborne spectrographic imager.

"We were by ourselves in the early years - there was a feeling of isolation. But now things have changed. We're developing more linkages, making more contacts. The environment for a high-tech company is important. When it's friendly, like it is in Alberta, it means you're appreciated."

While some advanced technology

Anger believes that Alberta's space instrumentation sector is reaching critical mass. He predicts that Alberta will have a significant hardware capability for space instrumentation within the next decade.

Even a big company like Calgary's NovAtel Communications Ltd. has found benefits in the growth of Science City. NovAtel is Canada's only designer, manufacturer and marketer of cellular radio products for the world market. John Burrows, NovAtel's chairman of the board, says as advanced technology businesses grow in number so does the likelihood that NovAtel will find a supplier close by.

"As infrastructure grows, there are more competent suppliers and vendors at our doorstep. This is very important to any manufacturing company. For NovAtel, it means we don't have to stockpile as much inventory because we can get it from suppliers in the city. It's

employment, jobs in Alberta become more attractive.

The in-province labor market has also improved. When Myrias Research Corporation needed an attractive "box" for its supercomputer, the company found an Edmonton firm - Designworks Phase I Inc. - to take on the job. Years ago, before the growth of Science

science careers as early as junior high."

NovAtel's Burrows agrees. "The kind of activity we're seeing now in science and technology in Alberta feeds on itself," he says. "It means more opportunities for our children. Consequently more of them are inclined to take training in advanced technologies."

Although the opportunities are here, Science City is not an isolated community. The prevailing view in business is outward, not inward. For advanced technology products and services, markets are global and Alberta companies have their sights set far beyond provincial borders.

"Science City must link to the outside world; it's the only way we'll remain competitive," says Dr. Clem Bowman, president of the Alberta Research Council (ARC).

While Alberta companies crack international markets, the ARC is laying the groundwork for another type of linkage - networking. It is stepping up its efforts in collaborating with other provincial research organizations, the National Research Council, universities and other scientific and engineering centres of excellence.

"I think of networking as an efficient subway system in Science City - a fast way to link up with other science cities," Bowman explains. "It means being able to tap into technology that is being developed throughout the world and putting it to work here in Alberta. We're in a much stronger position because of this inter-city communication."

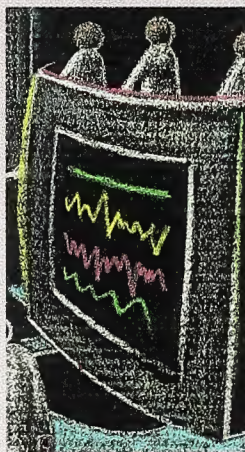
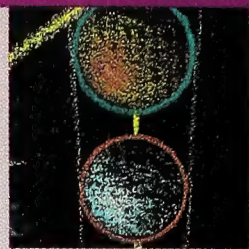
City, this would likely have been an out-of-province job.

"Designworks did a spectacular job," says Ken Gordon, director of business development for Myrias. "It was evident at the supercomputing show in Nevada in November that the Myrias box was the most striking."

"As Alberta's infrastructure develops, we expect to have more of our components manufactured in the province."

And that means more jobs for Albertans. Gordon Politeski, president of Edmonton-based biotechnology company Biomira Inc., is one of a number of Albertans concerned with raising personal awareness of science and technology so that the province's young people can take advantage of the opportunities in Science City.

"Alberta has made a sincere commitment to diversify the provincial economy through science and technology," he says. "We must make sure our young people are prepared to take on the jobs. They've got to start learning about



Dr. Cliff Anger of ITRES: developing more linkages, making more contacts.

sector in Alberta - telecommunications, for example - are well developed, while space hardware are in a developing stage. With the recent establishment of the Administrative Centre for the Canadian Network for Space Research at the University of Calgary,

a very, very big advantage."

Burrows says a vibrant Science City also helps NovAtel attract engineers and technicians to Alberta by providing a different kind of job security. When prospective employees are sure there are opportunities for alternative



NovAtel's John Burrows sees more opportunities for Alberta's children.